Claims

1. A method for patterning a multilayer resist, comprising the steps of
depositing a first layer of resist material onto a substrate;
scanning a beam of radiation to expose a portion of the first layer of resist material;
depositing a second layer of resist material; and
scanning a beam of radiation to expose a portion of the second layer of resist material to radiation; and
varying the dose of radiation delivered to at least one region of the second layer.

2. The method of claim 1 wherein the step of varying the dose of radiation further comprises delivering more pulses of radiation to at least one region.

3. The method of claim 1 wherein the step of varying the dose of radiation further comprises delivering radiation for a longer period of time to at least one region.

4. The method of claim 1 wherein the step of varying the dose of radiation further comprises delivering an increased fluence of radiation to at least one region.

5. The method of claim 1 wherein the method further comprises varying the dose of radiation delivered to at least one region of the first resist layer.

6. The method of claim 1 wherein the steps are repeated until a pattern having greater than two layers has been completed.

7. The method of claim 1 wherein the method further comprises treating the layers with a developing solution to remove the exposed portions of resist when resist is a positive resist or remove the unexposed portions of resist when the resist is a negative resist.

8. The method of claim 1, wherein the method further comprises heating the resist following at least one exposure step.

9. The method of claim 1, wherein the resist material is a positive resist.

10. The method of claim 1, wherein the resist material is a negative resist.

11. The method of claim 1, wherein the resist material is a novolac resin.

12. The method of claim 1 wherein the step of varying the dose of radiation further comprises delivering an increased fluence of radiation to at least one interior region.

13. The method of claim 1 further comprising:

depositing a first layer of photoresist onto a substrate;

exposing first portions of the first layer to a first dose of radiant energy;

depositing a second layer of photoresist atop the first layer;

exposing second portions of the second layer to a second modulated dose of radiant energy;

wherein modulation of the second modulated dose is determined as a function of second portion locations that reside atop first portions; such second portion locations being interior portions; the dose greater for interior portions than for other second portions.

14. The method according to claim 13, wherein exposing and depositing are repeated a number of times, n, thereby creating an n-layer photoresist preform.

15. The method according to claim 14, wherein modulation of an n-th modulated dose is determined as a function of n th portion locations that reside atop (n-1)st portions; the dose greater at n th portion locations that reside atop (n-1)st portions.

16. A method according to claim 1 further comprising the steps of:

predefining a desired pattern including a vertical profile of exposed and unexposed regions in different layers of a multi-layer resist;

patterning the multilayer resist by repeated depositing layers and exposing portions of each layer to radiation; and

varying a dose of radiation delivered to certain portions of the layers to take into account light penetration between resist layers in order to obtain a uniform predetermined exposure level in each layer.

17. The method of claim 16, wherein the radiation exposure is performed with a laser based vector scanning system.

18. A method of efficiently patterning interior portions of a multilayer photoresist preform, the preform having a perimeter such that interior portions of a layer have interior locations at least a predetermined distance from the periphery, distance from the perimeter measured essentially perpendicular to a central axis of the preform, the method comprising:

depositing a first layer of photoresist onto a substrate;

exposing first portions of the first layer to a first dose of radiant energy;

depositing a second layer of photoresist atop the first layer;

exposing second portions of the second layer to a second modulated dose of radiant energy;

wherein the second modulated dose is modulated as a function of relative spatial location of the first and second portions, the dose greater for interior portions.

19. A method of efficiently patterning portions of a photoresist preform, the preform having a perimeter, the distance from the perimeter measured essentially perpendicular to a central axis of the preform, the method comprising:

calculating a maximum and a minimum spot size for radiant energy delivery, delivery essentially parallel to the central axis;

depositing a first layer of resist onto a substrate;

exposing first portions of the first layer to radiant energy delivered essentially parallel to the central axis, wherein the spot size of radiant energy used to expose the first portions is increased proportionally with an increase in the smaller of distance from the perimeter.